



3RD WING
Trenching and Excavation Overview



TRENCHING & EXCAVATION

Part of the “Hole” Story

**presented by:
3rd Wing Safety**



It's the Law

- **OSHA 29 CFR 1926.650 - 652**
- **AFOSH Std 91-10**





Definitions

- **Excavations (including Trenches):** any man-made cut, cavity, trench or depression in an earth surface, formed by earth removal
- **Trench:** a narrow excavation, relative to the length, made below the surface of the ground - generally, the width at the bottom of the trench is not greater than 15-feet



The Dirty Facts

- **A cubic foot of “dirt” weighs about 100#**
- **A cubic yard of “dirt” weighs about 2,700#**
- **In a collapsing trench, “dirt” falling a distance of only 10-feet can move about 25 feet per second**
- **A trench or excavation that is not supported *WILL* collapse...eventually**



Before Excavating

- ☑ **Contact the utility flights of CES to locate underground installations and all other agencies on the digging permit**
- ☑ **Remove or support objects in the excavation area that could pose a hazard to employees**
- ☑ **Classify the soil type**
- ☑ **Prepare for possible emergency operations**



Soil Classification

- **The following is a short explanation of soil classifications. You should check the standard for detailed information regarding classifying soils.**
- ***Type A soils***
 - **cohesive soils that have an unconfined compressive strength of 1.5 tsf or greater**
 - **e.g., clay, silty clay, sandy clay & clay loam**



Soil Classification

- **Type A soils *cannot* have or be subjected to the following:**
 - fissures
 - subjection to vibration from heavy traffic, pile driving or similar conditions
 - been previously disturbed
 - or if it has been subjected to other factors that would change its' classification



Soil Classification

- **Type B soils**
 - **cohesive soils that have an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf**
 - **e.g., angular gravel, silt, silt loam, sandy loam and previously disrobed soils except those which would be classified as Type C soil**



Soil Classification

- **Type B soils (cont.)**
 - **also includes soils that meet some of the requirements of Type A soils but is fissured or subject to vibration; or dry rock that is not stable**



Soil Classification

- **Type C soils**
 - **cohesive soils with an unconfined compressive strength of 0.5 tsf or less**
 - **e.g., granular soils including gravel, sand and loamy sand**
 - **also submerged soil or soil from which water is freely seeping or submerged rock that is not stable**



Soil Classification

- ***Stable rock***
 - a natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed



How Do You Classify?

- **Only a “competent” person can perform the classification test**
 - **“competent”**: one who is *capable* of identifying existing & predictable hazards & who has *authority* to make prompt corrective actions
 - **do you have one on staff?**





How Do You Classify?

- **Several methods are available - this includes at least one visual and at least one manual analysis in the field**
- **Details of the testing methods are included in Appendix A of the Excavation Standard**





Excavations and Trenching

What Type of Soils Do We Typically Encounter Here?



Excavations and Trenching

- **Now That The Soil Is Classified...
Can We Enter?**
- **No!**



Let's Share Some Information

- **Why do we have cave-ins...**



Common Causes of Trench Failure or Collapse

- **Soil types - less cohesive strength usually equates to less stability**
- **Moisture - too much or too little water could lead to failure or collapse**
- **Previously disturbed soils - are generally less stable than undisturbed soils**
- **Freezing & thawing - expansion and contraction action affects stability**



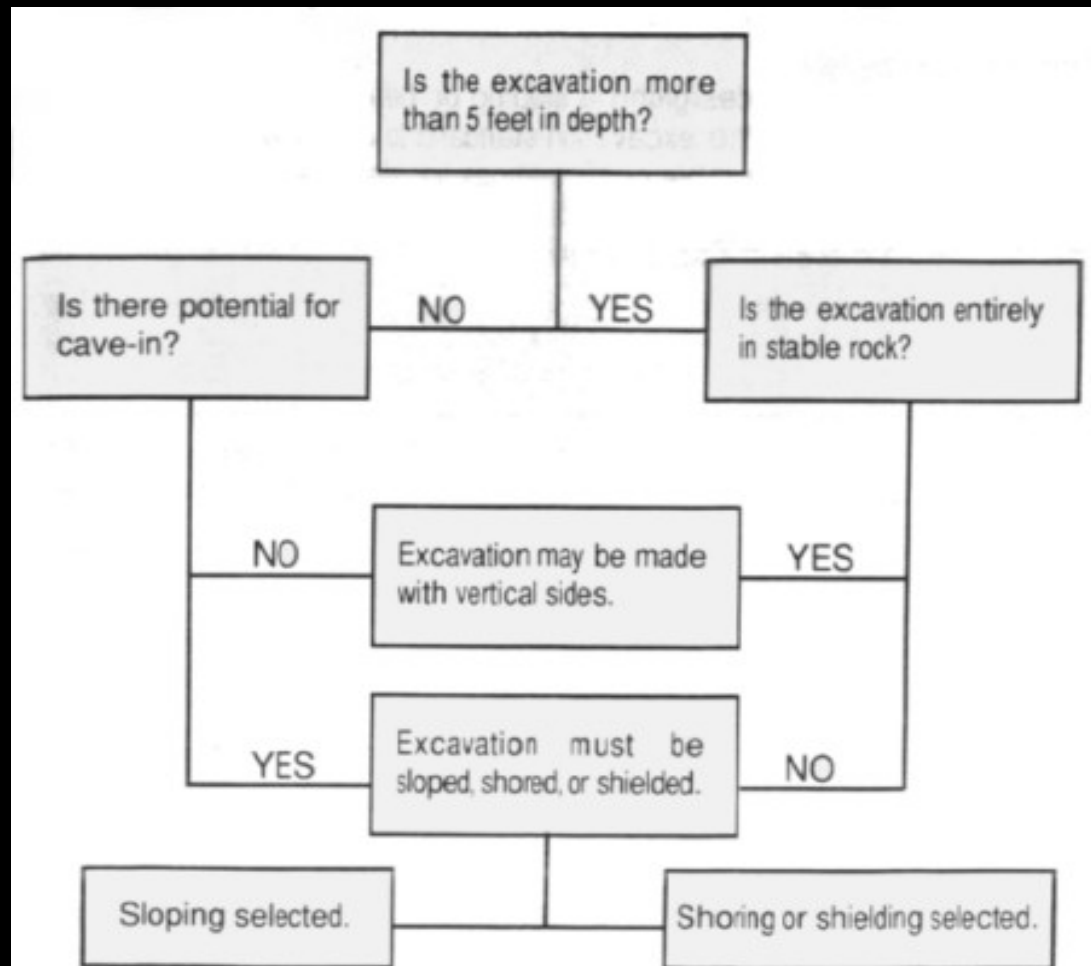
Common Causes of Trench Failure or Collapse

- **Surcharged loads - weight of construction equipment, supplies and materials**
- **Shock & vibration - moving equipment, near-by traffic, construction processes, etc.**
- **Intersecting trenches - corner portions have less support and stability**



So, Do Not Enter...Until

- **Completion of a decision flow chart is done**
- **Adequate precautions are taken**





Protect the Workers

- **Sloping**
- **Benching**
- **Shoring**
- **Shields**
- **NOTE: Excavations greater than 20-feet in depth will require a protective system designed by a registered professional engineer.**





Selection of Protective Systems

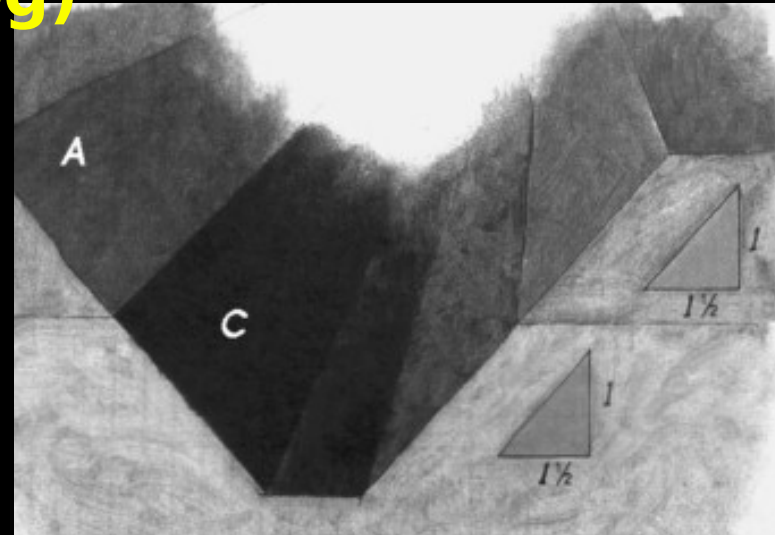
- **Depending on the site conditions and circumstances**
- **Depending on the availability of the protective systems**
- **Depending on the scope of work involved**



Sloping

- **Maximum allowable slopes**
 - **stable rock: vertical (90 deg)**
 - **type A: 3/4:1 (53 deg) ***
 - **type B: 1:1 (45 deg)**
 - **type C: 1 1/2:1 (34 deg)**

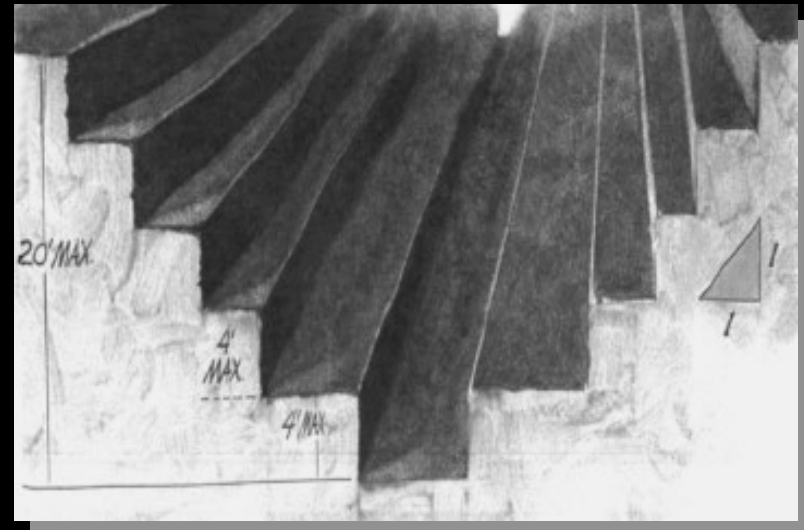
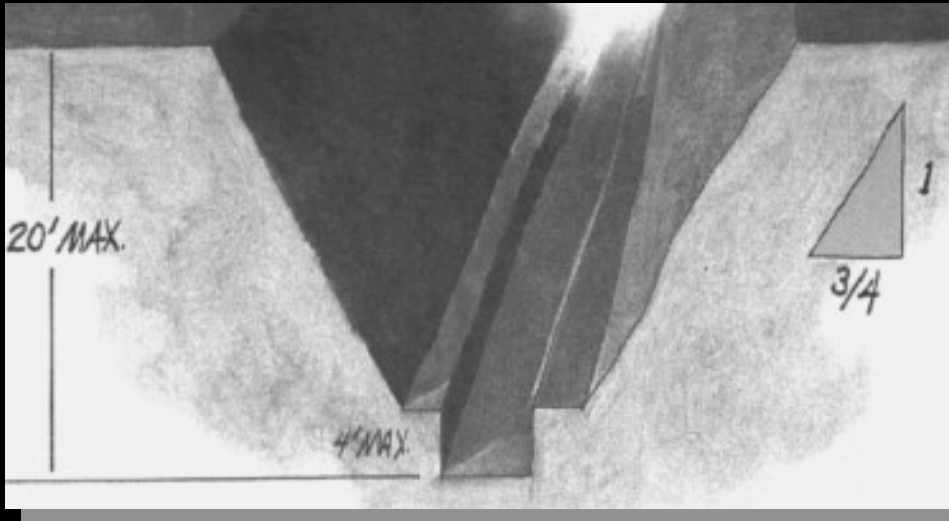
*** 1/2:1 (63 deg) slope is allowed for only short term excavations that are 12-feet deep or less**





Benching

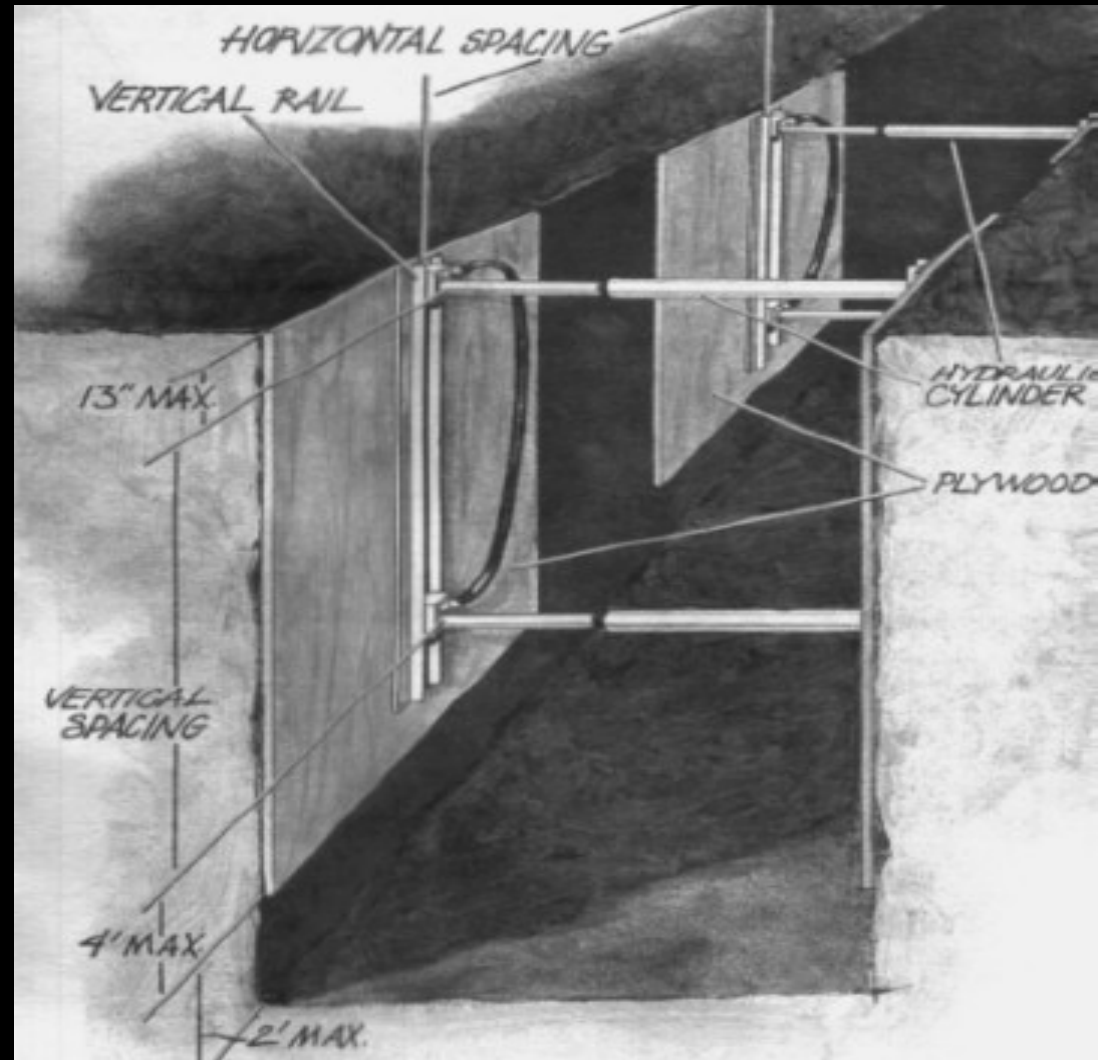
- Simple & multiple bench
- Angles are dependent upon soil type





Shoring

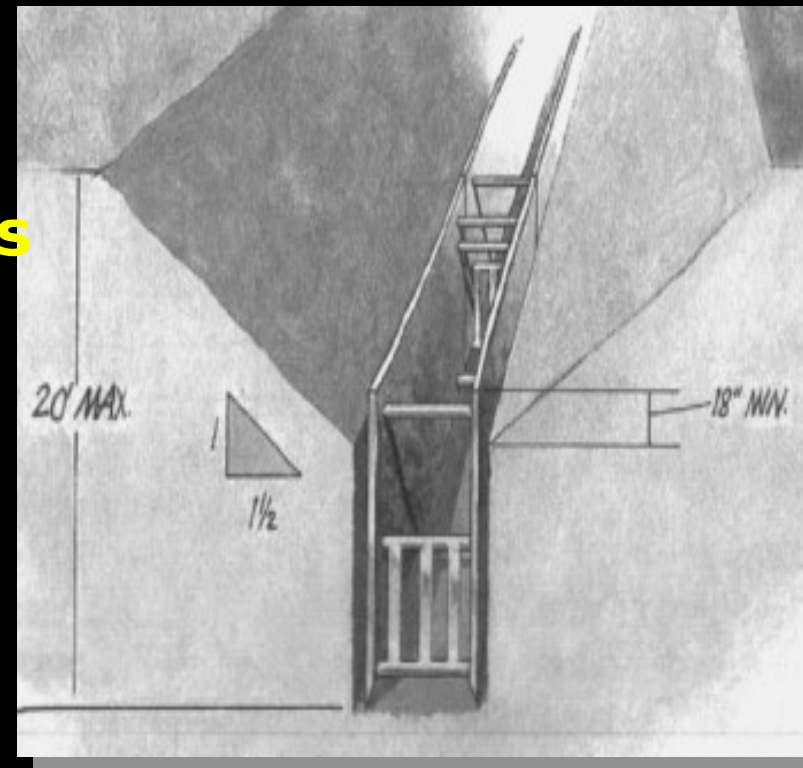
- Hydraulic
- Timber
- Air shores
- Screw jacks





Shields

- **Designed to withstand intended loads**
- **Must not move in trench**
- **Employees always in shields**
- **Must extend 18-inches over the vertical side**





Other Considerations

- **Surcharged loads**
- **Adequate access & egress**
- **Confined space considerations & hazards**
- **Fall protection**
- **Environmental conditions**
- **Emergency action plan**
- **Public protection**



Surcharged Loads

- **Stationary (dead) loads**
 - **parked construction equipment & vehicles**
 - **spoil material 2-feet from edge**
 - **construction supplies and material**
- **Live loads**
 - **shock and vibration from operating equipment, vehicles, pile driving, blasting, nearby operations and foot traffic**



Adequate Access & Egress

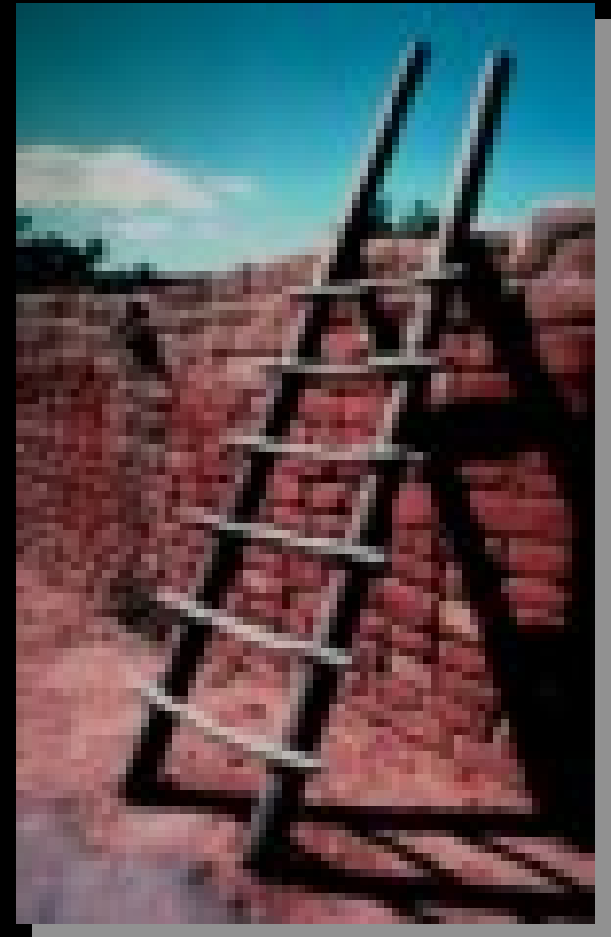
- **Structural ramps**
 - **employee use**
 - **designed by competent person**
 - **employee & equipment use**
 - **designed by competent person qualified in structural design**





Adequate Access & Egress

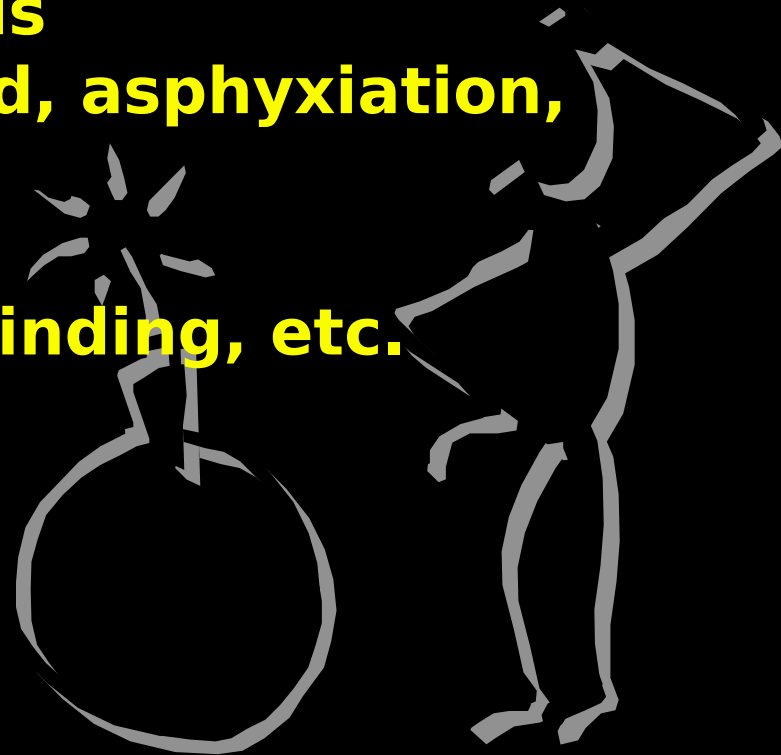
- **Stairways or ladders**
 - properly designed
 - located not more than 25 feet (laterally) from the employee





Confined Space Considerations & Hazards

- **Hazardous atmospheres**
 - adequate and safe oxygen content
 - toxic or flammable gases
- **Other potential hazards**
 - engulfment, trapped, asphyxiation, de-watering, etc.
- **Contributing hazards**
 - welding, cutting, grinding, etc.





Fall Protection

- **Protection must be provided**
 - **if there is a potential for people or equipment falling into the excavation**
 - **guardrails or other protective means shall be provided**





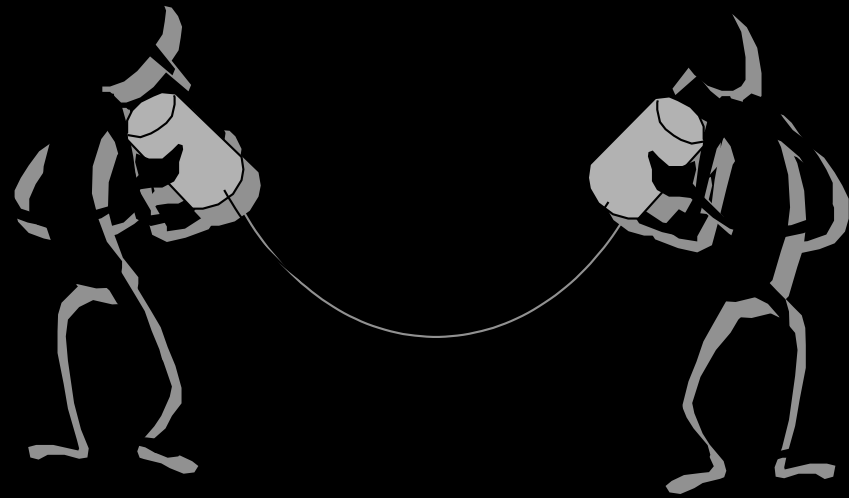
Environmental Conditions

- **Typical weather conditions**
 - **what can be reasonably expected as typical for the area**
- **Potential weather changes**
 - **seasons**
 - **rain fall etc.**
- **Natural phenomenon**
 - **earthquakes, etc.**



Emergency Action Plan

- **Communication equipment**
 - radio, telephone, etc.
- **Emergency phone numbers and contacts**
 - fire department, medical facilities, etc.





Emergency Action Plan

- **Rescue/retrieval equipment, operations and procedures**
 - tripod, harness, winch, etc.
- **Emergency personnel and facilities**
 - notifying rescue and medical facility of work and potential accidents



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Public Protection

- **Guarding of open trenches or excavations**
 - physical barriers
 - security
- **Back-filling of trenches or excavations**
- **Limiting open trench or excavation work**





Now...Are We Ready To Enter?

- **It depends...**
- **Do we have a “competent person”**
 - **to classify soils**
 - **to design ramps, access, etc.**
 - **to design, if applicable, protective systems or slopes**
 - **to conduct inspections of the excavations**



Now...Are We Ready To Enter?

- **For excavations over 20-feet deep, are the protective systems or slopes designed by a registered professional engineer?**
- **Do we have the proper protective equipment or procedures to address safety issues**



Finally...

- **Review the standard...there is a lot of specific information in the standard**
- **Document all tests, inspections, etc. regarding trenching and excavation work**
- **Ask questions if you are unsure of the situation**